

Report from the Airplane Performance Harmonization Working Group

Issue: Go-Around Obstacle Clearance

Rule Section: FAR 121.195/JAR-OPS 1.510

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

It is fundamental to operational safety that the pilot should be able to safely execute a go-around upon arrival at the destination and alternate airports. This principle has formed the basis of the performance standards required for the type certification and operation of turbine engine powered transport category airplanes since Special Civil Air Regulation No. SR-422, effective August 27, 1957. As of March 20, 1997, the application of this principle was extended by the “commuter rule” to also cover scheduled passenger-carrying operations conducted in airplanes that have a passenger seat configuration of 10 to 30 passengers and turbojet airplanes regardless of seating configuration.

2 - What are the current FAR and JAR standards relative to this subject? [Reproduce the FAR and JAR rules text as indicated below.]

Current FAR text:

Part 121

FAR 121.195 Airplanes: Turbine Engine Powered: Landing Limitations: Destination Airports

- (a) No person operating a turbine-engine-powered airplane may take off that airplane at such a weight that (allowing for normal consumption of fuel and oil in flight to the destination or alternate airport) the weight of the airplane on arrival would exceed the landing weight set forth in the Airplane Flight Manual for the elevation of the destination or alternate airport and the ambient temperature anticipated at the time of landing.

Part 135

FAR 135.385 Large Transport Category Airplanes: Turbine Engine Powered: Landing Limitations: Destination Airports

- (a) No person operating a turbine engine powered large transport category airplane may take off that airplane at a weight that (allowing for normal consumption of fuel and oil in flight to the destination or

alternate airport) the weight of the airplane on arrival would exceed the landing weight in the Airplane Flight Manual for the elevation of the destination or alternate airport and the ambient temperature anticipated at the time of landing.

Current JAR text:

**JAR-OPS 1.510 Landing – Destination and Alternate Aerodromes
(See AMC OPS 1.510 and 1.515)**

- (a) An operator shall ensure that the landing mass of the aeroplane determined in accordance with JAR-OPS 1.475(a) does not exceed the maximum landing mass specified for the altitude and the ambient temperature expected for the estimated time of landing at the destination and alternate aerodrome.
- (b) For instrument approaches with decision heights below 200 ft, an operator must verify that the approach mass of the aeroplane, taking into account the take-off mass and the fuel expected to be consumed in flight, allows a missed approach gradient of climb, with the critical engine failed and with the speed and configuration used for go-around of at least 2.5%, or the published gradient, whichever is the greater. The use of an alternative method must be approved by the Authority. (See IEM OPS 1.510(b)).

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed? [Reproduce text from issue papers, special conditions, policy, certification action items, etc., that have been used relative to this issue]

N/A

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in? [Explain the differences in the standards or policy, and what these differences result in relative to (as applicable) design features/capability, safety margins, cost, stringency, etc.]

FAR 121.195(a), FAR 135.385(a) and JAR-OPS 1.510(a) are, for all practical purposes, identical. Each requires that the weight of the airplane upon arrival at the destination and alternate airports (based on the takeoff weight and the expected fuel consumption en route) not exceed the maximum allowable landing weight shown in the Airplane Flight Manual (AFM) (typically referred to as WAT limits) for the altitude of the airport and the temperature expected at arrival time. The landing weight limitations provided in the AFM ensure only that the airplane can meet certain climb gradient requirements established by the respective certification rules (FAR 25, JAR 25) and, as such, do not guarantee obstacle clearance during a go-around.

JAR-OPS 1.510(b) has no counterpart in FAR 121 or FAR 135. It requires additional climb gradient capability for some instrument approaches. It was introduced because most airports used by JAR operators have instrument approach procedures which are designed in accordance with ICAO PANS-OPS criteria, FAA TERPS or similar, and which are intended to ensure adequate obstacle clearance during both the approach and missed approach phases. For the latter, these procedures are normally based on a nominal missed approach climb gradient of 2.5%, (ICAO and TERPS criteria) though at some airports that are surrounded by significant obstacles, a higher climb gradient is specified (PANS-OPS criteria only). The desired obstacle clearance during a missed approach with an engine out, when the published procedure is flown, could be inadequate if the aircraft's performance does not enable climb at the specified gradient. Additionally, the requirement to show compliance with the climb gradient using data based on the speed and configuration actually used for go-around is intended to ensure consistency between the airplane performance capability and the procedures used by the operator. (For some airplanes the AFM approach climb gradient is computed with a configuration that is not the same as the recommended go-around configuration.)

While not specifically addressed in the FARs, the FAA has expected operators to show adequate obstacle clearance during a missed approach at certain airports with particularly difficult terrain issues. The FAA's approach historically has been to require the operator to develop missed approach procedures to provide obstacle clearance rather than impose a weight penalty at the time of dispatch. Only in the most extreme cases would a weight penalty be required. Approval of such procedures was done on an individual operator basis. Recently, as part of the All Weather Operations Harmonization effort, the FAA revised Advisory Circular 120-29 (now AC 120-29A) to, among other things, include considerations for the development of missed approach procedures. The purpose was to consolidate and standardize the various methods used by operators to show obstacle clearance in the past. Included in the considerations for development of missed approach procedures is a requirement to consider the failure of an engine at all points along the approach path down to touchdown.

The ICAO PANS-OPS procedures (which the JAA follows), as well as FAA TERPS procedures, do not consider the loss of an engine beyond the missed approach point due to the remote possibility of such an occurrence.

The Working Group discussed the practical problems with a dispatch rule intended to provide obstacle clearance during a go-around. Currently, operators comply with dispatch landing requirements on the basis of the best available weather reports and/or forecasts. The operator often does not know the specific runway the airplane will use for landing when it arrives at the destination or alternate airport. This is especially true for long flights where many hours may pass between the time of dispatch and the time of arrival. Thus, the operator may base the dispatch weight on a runway with no obstacles in the missed approach area and actually land on a different runway with significant obstacles. The landing distance requirements address this issue by including both the "most

favorable runway” and the “most suitable runway” and have large built-in safety factors. The JAR addresses obstacle clearance only for instrument approaches and the operator may not know what the exact conditions will be upon arrival. Again, the operator may base the dispatch weight on not expecting to conduct an instrument approach, and may have different conditions when arriving.

On the other hand, the specific runway to which the airplane was dispatched is not as critical in the FAA’s approach. The FAA would require operators to have procedures in place, where appropriate, to ensure obstacle clearance when the missed approach is actually flown.

The additional requirements of JAR-OPS 1.510(b) may impose a takeoff weight penalty for JAR operators that is not required for FAA operators when operating under the same conditions with the same airplanes.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

The differences in the means of compliance are due to the differences in the standards. Where the standards are the same (i.e. application of AFM weight limits), the means of compliance are the same.

5 – What is the proposed action? [Describe the new proposed requirement, or the proposed change to the existing requirement, as applicable. Is the proposed action to introduce a new standard, or to take some other action? Explain what action is being proposed (not the regulatory text, but the underlying rationale) and why that direction was chosen for each proposed action.]

The Working Group could not reach consensus on JAR-OPS 1.510(b), primarily because of the wide differences in philosophy between the FAA and JAA; therefore, this issue cannot be recommended for full harmonization.

The FAA’s position is based on the principle that the potential for a go-around at any point between the initiation of the approach and touching down on the runway should be addressed, including consideration of an engine failure. This issue may be handled procedurally (initially through AC 120-29A, and finally through AC 120-XXX) and does not require a dispatch rule. For many airports with no particular go-around safety vulnerabilities (e.g. Dallas-Ft Worth, Phoenix, Amsterdam), there may not be a need to perform a detailed analysis or develop special procedures. For others, the operator might have to show that their current missed approach procedure avoids any obstacles laterally, and is robust enough to handle the conditions that they are approved to operate in. Another option would be for the operator to show that the obstacles can be cleared vertically, or with some combination of lateral/vertical clearance using their current procedures. In other cases, the operator may want to use the corresponding takeoff procedures for that runway and show that the transition to the takeoff flight path can be

made. In other cases, a unique procedure may need to be developed, using whatever combination of lateral/vertical clearance, navigational capabilities, etc. may be necessary.

The FAA and U.S. operators are concerned that the JAA requirement could subject operators to a weight offload for any approach with a decision height under 200 feet, regardless of whether there is any appreciable terrain in the airport vicinity. For airports where terrain may be an issue, there may also be a weight penalty, but a safe go-around (even with all engines operating) is not assured after the missed approach point is passed.

Under the FAA proposal, there will not be any weight offloads when there is no appreciable terrain in the airport vicinity, and also not in other cases if obstacle clearance can be assured by a combination of procedural and performance means. However, safety is addressed all the way to touchdown (actually until the engines are spooled down), and considers an engine failure. The FAA does not envisage requiring comprehensive data to be provided in the AFM, but operators will need some additional performance data from the manufacturers whenever a more detailed performance assessment might be necessary.

The JAA is convinced that obstacle accountability during go-around warrants an operating rule for consideration at dispatch. The JAA has remained unconvinced that advisory circular material in the absence of an operating rule will be consistently applied. The JAA is satisfied that the possibility of an engine failure beyond the missed approach point is too remote to require consideration. Additionally, the JAA is concerned that a mismatch between AFM approach climb gradient data for some airplanes and the recommended go-around procedures has serious safety implications. In the JAA's opinion, the FAA's proposal is too stringent in requiring consideration of an engine failure at all points along the approach path, but is also inadequate by not incorporating a dispatch requirement.

One minor aspect of the rules recommended for harmonization is to replace elevation (FAR 121.195(a) and FAR 135.385(a)) and altitude (JAR-OPS 1.510(a)) with pressure altitude and add a statement to allow the use of elevation when the pressure altitude cannot be determined. This is being done because the maximum landing weight charts in the AFM are presented as a function of pressure altitude. The provision to use elevation when pressure altitude is not known was added because typical weather forecasts do not include pressure altitude. It is intended, however, that an operator use pressure altitude when it can be determined.

During the harmonization discussions, the JAA recognized that further strengthening of JAR-OPS 1.510 was needed and, having taken note of the discussions outlined, proposed changes which were under development at that time. These changes are being introduced to ensure that the approved performance data and the recommended procedures are consistent with each other and also with the instrument approach procedures in which the airplane is operated.

The JAA justification for developing and retaining an operational rule is based upon the following :

- 1) JAR-OPS 1.510(b) is intended to ensure that minimum climb gradients commensurate with obstacle clearance requirements are met.
- 2) An operating rule to be considered at dispatch will ensure adequate and uniform accountability.
- 3) The rule shall apply to all instrument approaches, not just those with decision heights below 200 feet.
- 4) Compliance with the rule shall be tied to approved recommended go-around procedures.
- 5) The JAR is based upon standards set out in the ICAO Airworthiness Technical Manual Doc 9051-AN/896.
- 6) The intention of the regulation is aimed at keeping the aircraft within a confined and regulated airspace free from obstacles. Consequently it avoids the significant burden which would otherwise be placed upon operators associated with the need to conduct a detailed analysis matching the aircraft's flight path to the particular obstacle environment. Such data is currently not available to the operators.
- 7) Removal of the minimum gradient requirement of 2.5% in the absence of obstacles.
- 8) It is intended that compliance with the JAR will be by means of climb gradients associated with the approach climb and scheduled in the AFM. This aspect will greatly simplify the compliance finding with the regulation and help the operator to avoid the problems associated with lack of suitably approved performance information.
- 9) Consideration of the go-around from the decision height and not below reflects the ICAO standard which has been in use for many years. The JAR has the flexibility to allow a balancing between obstacle clearance altitudes/heights and required gradients to best suit a particular set of operational circumstances.
- 10) PERF HWG WP 11-1 (see attachment 1) has shown that protracted low altitude flight is required to achieve the flap configuration and/or speed associated with the AFM approach climb WAT limit. The intention of the JAR is to address this significant operational concern by establishing a WAT limit with the specified go-around flap and limiting the acceleration required to achieve the specified go-around speed to no more than 10 knots above the landing threshold speed.

- 11) Issues of obstacle data availability and the reality that at most airports air traffic controllers are not aware of an individual operator's emergency procedures and routes (same is the case with take-off contingency procedures).

Reference shall be made in the rule to "The use of an alternative procedure and/or method must be accepted by the Authority." This will provide accommodation for compliance using other means should the applicant seek to retain currently certificated procedures which do not comply with use of approach flap and speeds no greater than the landing threshold speed plus 10 knots. In addition in the interest of harmonization other means possibly based upon the FAA proposed standard could be considered should the relevant Authority agree.

Also, during the discussions it was decided to revise the wording in FAR 121.195(a) and 135.385(a) to remove reference to the alternate airport. This was done because the titles of each of these paragraphs specifically refer to Destination Airports. FAR 121.197 and FAR 135.387 will be revised to include the appropriate requirements for alternate airports.

The Working Group recommends that the sections of draft AC 120-29A dealing with specific go-around obstacle clearance procedures be removed at the earliest convenient time and placed in AC 120-XXX. This would serve to consolidate all obstacle-related issues (takeoff and landing) into a single document that is more commonly used by the operators' performance experts.

6 - What should the ~~harmonized~~ revised standard be? [Insert the proposed text of the ~~harmonized~~ revised standard here]

Part 121

FAR 121.195 Airplanes: Turbine Engine Powered: Landing Limitations: Destination Airports

- (a) No person operating a turbine-engine-powered airplane may take off that airplane at such a weight that (allowing for normal consumption of fuel and oil in flight) the weight of the airplane on arrival would exceed the landing weight set forth in the Airplane Flight Manual for the pressure altitude of the destination airport and the ambient temperature anticipated at the time of landing. When the pressure altitude at the anticipated time of landing cannot be determined from weather forecasts or reports, the elevation of the airport shall be used.

Part 135

FAR 135.385 Large Transport Category Airplanes: Turbine Engine Powered: Landing Limitations: Destination Airports

- (a) No person operating a turbine engine powered large transport category airplane may take off that airplane at a weight that (allowing for normal consumption of fuel and oil in) the weight of the airplane on arrival would exceed the landing weight in the Airplane Flight Manual for the pressure altitude of the destination airport and the ambient temperature anticipated at the time of landing. When the pressure altitude at the anticipated time of landing cannot be determined from weather forecasts or reports, the elevation of the airport shall be used.

7 - How does this proposed standard address the underlying safety issue (identified under #1)? [Explain how the proposed standard ensures that the underlying safety issue is taken care of.]

For the FAA, the underlying safety issue will be addressed by the application of advisory material (initially through AC 120-29A, and finally through AC 120-XXX). The proposed FAA standard does not provide any significant change relative to the existing practice.

For the JAA, the underlying safety issue is addressed by strengthening the standard. The JAA Performance Sub-Committee intends to propose a revision to JAR-OPS 1.510(b) for consideration by the JAA Operations Committee.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain. [Explain how each element of the proposed change to the standards affects the level of safety relative to the current FAR. It is possible that some portions of the proposal may reduce the level of safety even though the proposal as a whole may increase the level of safety.]

The proposed FAA standard maintains the same level of safety.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain. [Since industry practice may be different than what is required by the FAR (e.g., general industry practice may be more restrictive), explain how each element of the proposed change to the standards affects the level of safety relative to current industry practice. Explain whether current industry practice is in compliance with the proposed standard.]

The proposed FAA standard maintains the same level of safety. The inclusion of considerations for the development of missed approach procedures in AC 120-29A and, ultimately, in AC 120-XXX will increase the level of safety by standardizing the procedures used by operators.

10 - What other options have been considered and why were they not selected?

[Explain what other options were considered, and why they were not selected (e.g., cost/benefit, unacceptable decrease in the level of safety, lack of consensus, etc.) Include the pros and cons associated with each alternative.]

Harmonization was considered, but not selected, due to the reasons given in item #5.

11 - Who would be affected by the proposed change? [Identify the parties that would be materially affected by the rule change – airplane manufacturers, airplane operators, etc.]

JAA operators may be affected by the changes to JAR-OPS 1.510. The impact is expected to be minor.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

N/A

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted? [Indicate whether the existing advisory material (if any) is adequate. If the current advisory material is not adequate, indicate whether the existing material should be revised, or new material provided. Also, either insert the text of the proposed advisory material here, or summarize the information it will contain, and indicate what form it will be in (e.g., Advisory Circular, policy, Order, etc.)]

As explained in item #5, the Working Group recommends that the sections of AC 120-29A dealing with specific go-around obstacle clearance procedures be removed at the earliest convenient time and placed in AC 120-XXX. This would serve to consolidate all obstacle-related issues (takeoff and landing) into a single document that is more commonly used by the operators' performance experts.

14 - How does the proposed standard compare to the current ICAO standard?

[Indicate whether the proposed standard complies with or does not comply with the applicable ICAO standards (if any)]

The relevant ICAO standards for the "Airworthiness of Aircraft" (Annex 8) and "Operation of Aircraft" (Annex 6) do not contain standards for obstacle clearance during a go-around. The JAR is based on guidance material provided in the ICAO "Procedures for Air Navigation Services – Aircraft Operations" (PANS-OPS), and the ICAO Airworthiness Technical Manual Document 9051-AN/896.

15. – Does the proposed standard affect other HWG's? [Indicate whether the proposed standard should be reviewed by other harmonization working groups and why.]

No.

16 - What is the cost impact of complying with the proposed standard? [Please provide information that will assist in estimating the change in cost (either positive or negative) of the proposed rule. For example, if new tests or designs are required, what is known with respect to the testing or engineering costs? If new equipment is required, what can be reported relative to purchase, installation, and maintenance costs? In contrast, if the proposed rule relieves industry of testing or other costs, please provide any known estimate of costs.]

N/A

17. - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

N/A

18. – Does the HWG wish to answer any supplementary questions specific to this project? [If the HWG can think of customized questions or concerns relevant to this project, please present the questions and the HWG answers and comments here.]

The Working Group has identified a related issue pertaining to the FAR/JAR Part 25 airworthiness requirements and makes the following recommendation:

The discussions within the Working Group with respect to go-around related issues have highlighted a number of related issues with respect to compliance with JAR/FAR 25.121(d) which are discussed below.

1) Approach Climb Limit Weight Assumptions in Relation to Recommended Procedures.

JAR/FAR 25.101(g) states : “Procedures for the execution of balked landings and missed approaches associated with the conditions prescribed in JAR/FAR 25.119 and JAR/FAR 25.121(d) must be established.” Consequently the speeds and flap configuration assumed in the scheduling of landing WAT limits to comply with the minimum climb gradient requirements of JAR/FAR 25.121(d) need to reflect those arising from the recommended procedures. Certification experience has shown that compliance with this regulation has not been consistently achieved. In order to enhance approach climb limit weights, particularly for turbo-jet designs, higher speeds and lesser flap angles have been assumed in comparison with those promulgated in the recommended procedures section of the flight manual. This has resulted in a disconnect between procedures and compliance assumptions associated with 25.121(d). (See PHWG Paper 10-5).

JAR/FAR 25.121(d) permits the use of a climb speed established in connection with normal landing procedures, but not more than $1.5 V_S$. This can lead to accelerations of more than 30 knots between the initiation of go-around and achieving the climb speed assumed when showing compliance with JAR/FAR 25.121(d). In the engine-out case at a WAT condition this will result in a protracted exposure to flight at very low altitude

covering appreciable distances until the point at which the minimum climb gradient in JAR/FAR 25.121(d) is achieved. (See Attachment 1).

2) Acceptability Of Procedures.

JAR /FAR 25.101(h) states : "The procedures established under sub-paragraphs (f) and (g) of this paragraph must-

- (1) Be able to be consistently executed in service by crews of average skill,
- (2) Use methods or devices that are safe and reliable, and
- (3) Include allowance for any time delays in the execution of the procedures, that may reasonably be expected in service."

In the absence of additional guidance consistent and adequate compliance with this requirement is questioned in the context of demonstrating a go-around which incurs a protracted low altitude acceleration as described in paragraph 1.

3) JAR-AWO 243.

This JAR regulation requires a go-around climb gradient of at least 2.5% associated with operations involving decision heights below 200 ft and there is no FAR equivalent rule. Test work by CAA during validation of various US aircraft identified a problem that for a go-around on a twin-engine airplane with an engine failure at decision height, and with the remaining engine being accelerated from flight idle, could cause a loss of height greater than that available, resulting in ground impact. This was considered to be due to the need to accelerate to a speed considerably in excess of the approach speed, as permitted by 25.121(d), but with this speed not necessarily being stated in the procedures. The above could mean either the aircraft could hit the ground or that there was a protracted low altitude acceleration to achieve the scheduled gradient, neither result being satisfactory. Consequently CAA introduced a new approach climb limit weight of 2.5% gradient, irrespective of the number of engines, 2.5% being the PANS-OPS obstacle identification value. The above position has been essentially read across to JAR-AWO and JAR-OPS 1.

4) Recommendations.

It is recommended that additional guidance is developed for incorporation in the AC 25-7A, "Flight Test Guide for Certification of Transport Category Airplanes," which would be intended to emphasize the need to ensure that the speeds and flap configuration assumed in the scheduling of approach climb weight limits to comply with the minimum climb gradient requirements of JAR/FAR 25.121(d) need to reflect those arising from the recommended go-around procedures. It is also recommended that the speed range permitted to show compliance with FAR/JAR 25.121(d) is revised to avoid protracted exposure to flight at very low altitude covering appreciable distances until the point at which the minimum climb gradient in JAR/FAR 25.121(d) is achieved. In addition JAA should consider deletion of JAR-AWO 243 in parallel with strengthening the compliance methodology relating to JAR/FAR 25.121(d).

19. – Does the HWG want to review the draft NPRM prior to publication in the Federal Register?

Yes.

The following attachments are available from Linda Williams, (202) 267-9685.

Attachment 1 to PERF HWG Report 11

Attachment 1 to PERF HWG Report 11

Attachment 2 to PERF HWG Report 11

Attachment 2 to PERF HWG Report 11

Attachment 2 to PERF HWG Report 11

Attachment 2 to PERF HWG Report 11